# U.S. Environmental Protection Agency
# Underground Injection Control Program

***Draft Permits and Proposed Aquifer Exemption at the Dewey-Burdock In-Situ Uranium Recovery Site near Edgemont, South Dakota***

## Background:
## The Underground Injection Control Program

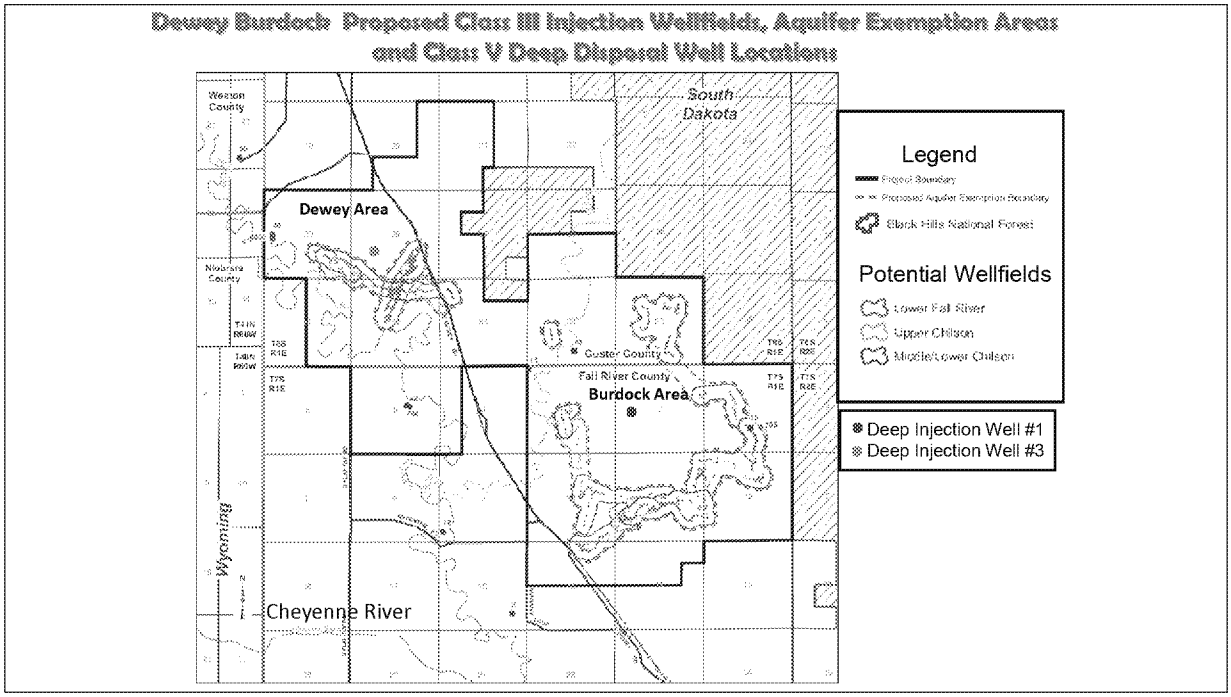
- Authorized under the Safe Drinking Water Act
- Mission: to protect Underground Sources of Drinking Water by regulating injection activity and injection wells.
- An "Underground Source of Drinking Water" (USDW) is defined by regulation as an aquifer (or portion)
  - Which supplies any public water system; or
  - Which contains a sufficient quantity of ground water to supply a public water system; and
    - Currently supplies drinking water for human consumption; or
    - Contains fewer than 10,000 mg/l total dissolved solids.
- Classifies injection wells under 6 classes based on type of injectate and purpose for injection activity.
- May exempt a portion of a USDW from protection under the program based on certain criteria.

# The Dewey-Burdock UIC Permits

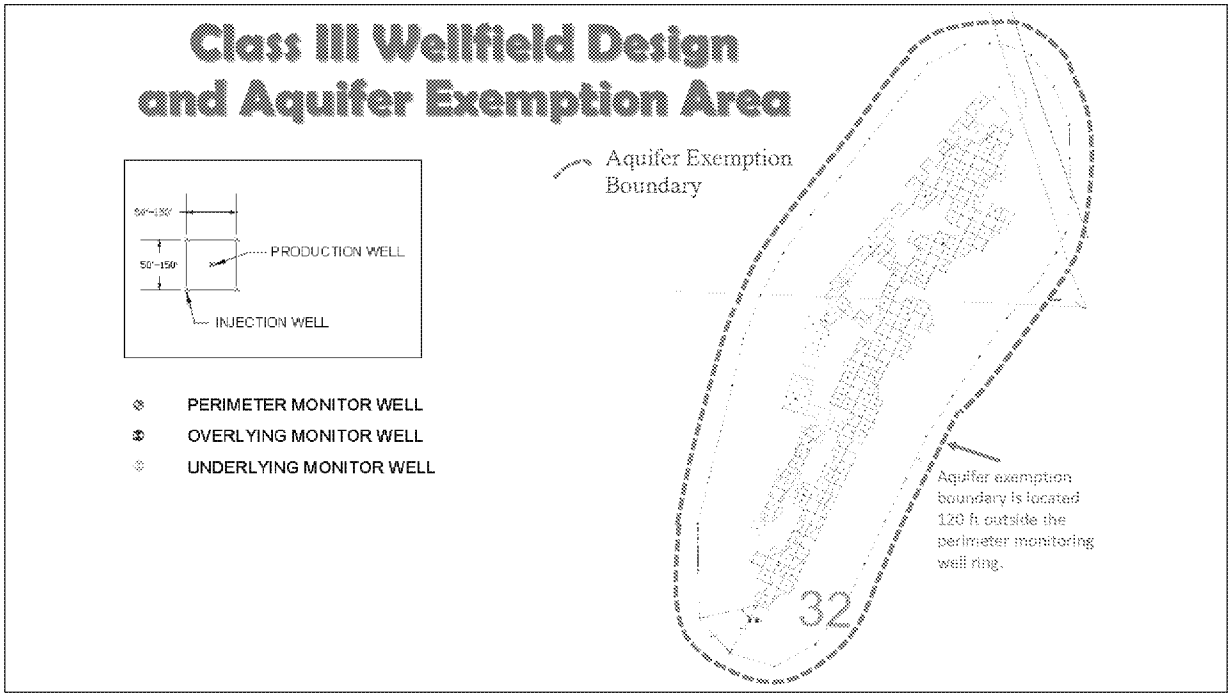
- The Region 8 UIC Program issued two draft area permits on March 6, 2017.
  - One draft permit is a Class III Area Permit for injection wells for the in-situ recovery (ISR) of uranium in Inyan Kara aquifers;
  - The second draft permit is a UIC Class V Area Permit for deep injection wells that will be used to dispose of ISR process waste fluids into the Minnelusa Formation after treatment to meet radioactive waste and hazardous waste standards.
- The EPA is also proposing an aquifer exemption approval in connection with the Class III Area Permit to exempt the uranium-bearing portions of the Inyan Kara Group aquifers.
- The EPA also released for comment:
  - a draft Environmental Justice Analysis,
  - a draft Cumulative Effects Analysis, and
  - a draft document explaining process and considerations for Tribal Consultation.
- The EPA is requesting public review and comment on all of these documents.

# Other Regulatory Agencies at the Dewey-Burdock Site

- The Nuclear Regulatory Commission issued a Materials License for the project.
- The South Dakota Department of Environment and Natural Resources has proposed issuance of a Large Mine Permit.
- The BLM approved a Plan of Operations for portions of the site on BLM land.
- The South Dakota Department of Environment and Natural Resources has proposed issuance of a groundwater discharge permit for the land application of treated ISR waste fluids.



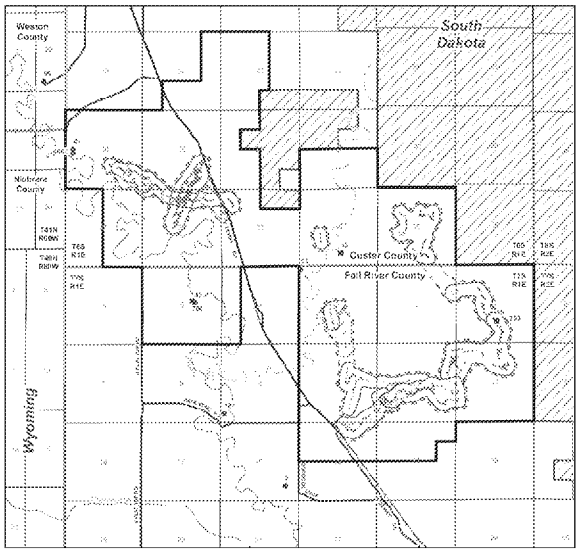

This slide shows the location of the site relative to
SD WY Border
Custer and Fall River Counties
Cheyenne River & Beaver Creek – explain there will be surface water monitoring of Beaver Creek and the Cheyenne River under DENR permit and NRC license
Point out:
Dewey Area & Burdock Area
4 proposed wellfields in Dewey Area & 10 proposed wellfields in the Burdock Area.
AE Boundary 120 feet outside of wellfield monitoring ring.
Locations of Deep Class V injection wells



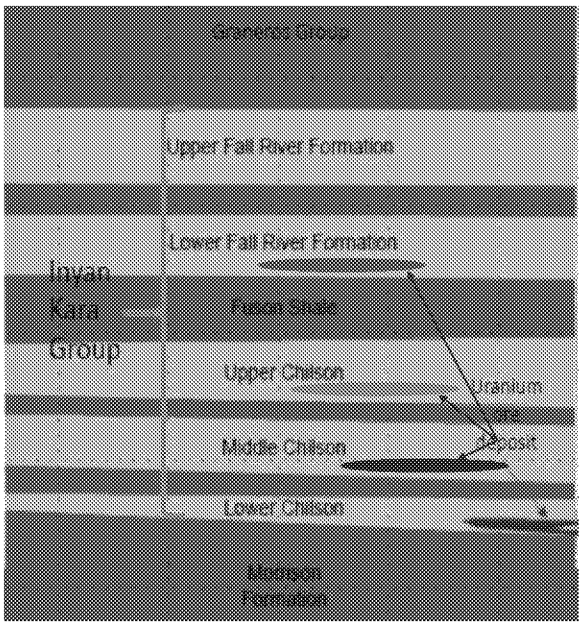

Dewey Wellfield 1
Explain injection and production well patterns
Both types of wells are regulated as injection wells
Discuss aquifer exemption regulation criteria and why the EPA is proposing approval of an aquifer exemption around uranium ore deposits
Inyan Kara aquifers have sulfate and manganese, and in some places iron, above the secondary drinking water standards (for taste and odor).
Well owners treat Inyan Kara groundwater with reverse osmosis before drinking it.

# Inyan Kara Water Quality within Aquifer Exemption Area

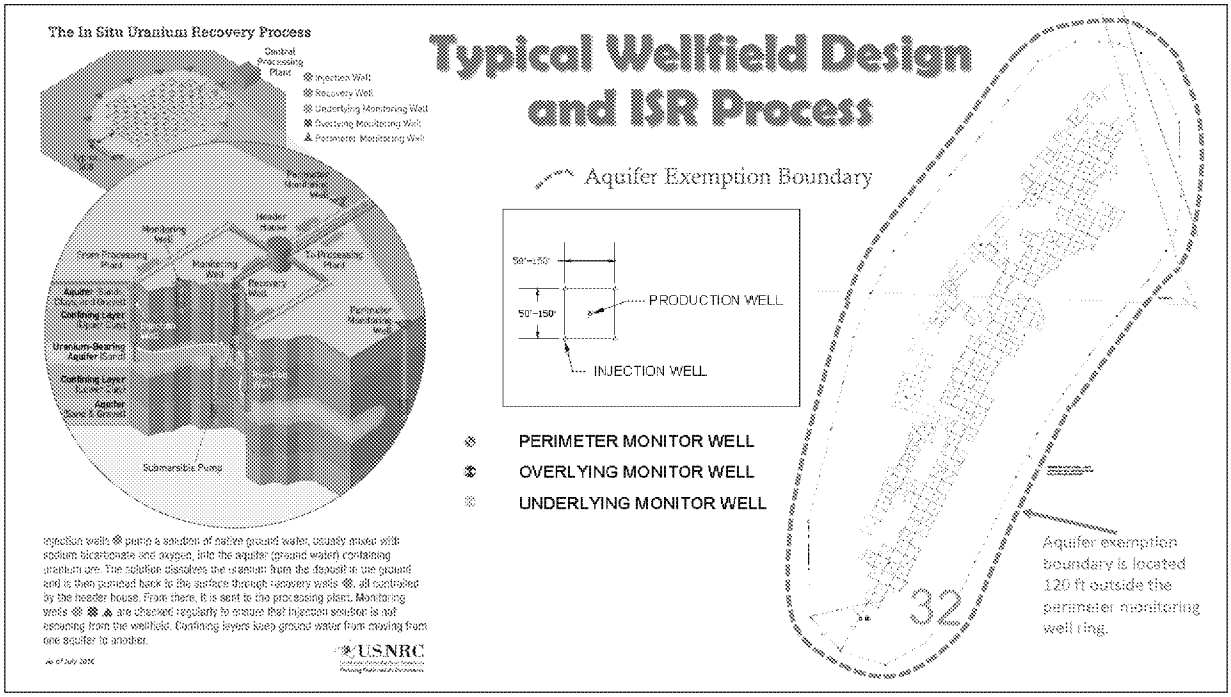
- Inyan Kara groundwater has to be treated before drinking to remove sulfate, manganese and iron.
- The Inyan Kara wells located within a uranium ore deposits also have high levels of gross alpha, radium and radon.
- Radioactive decay of uranium eventually results in radium, which quickly decays to radon and a series of daughter elements emitting alpha radiation.



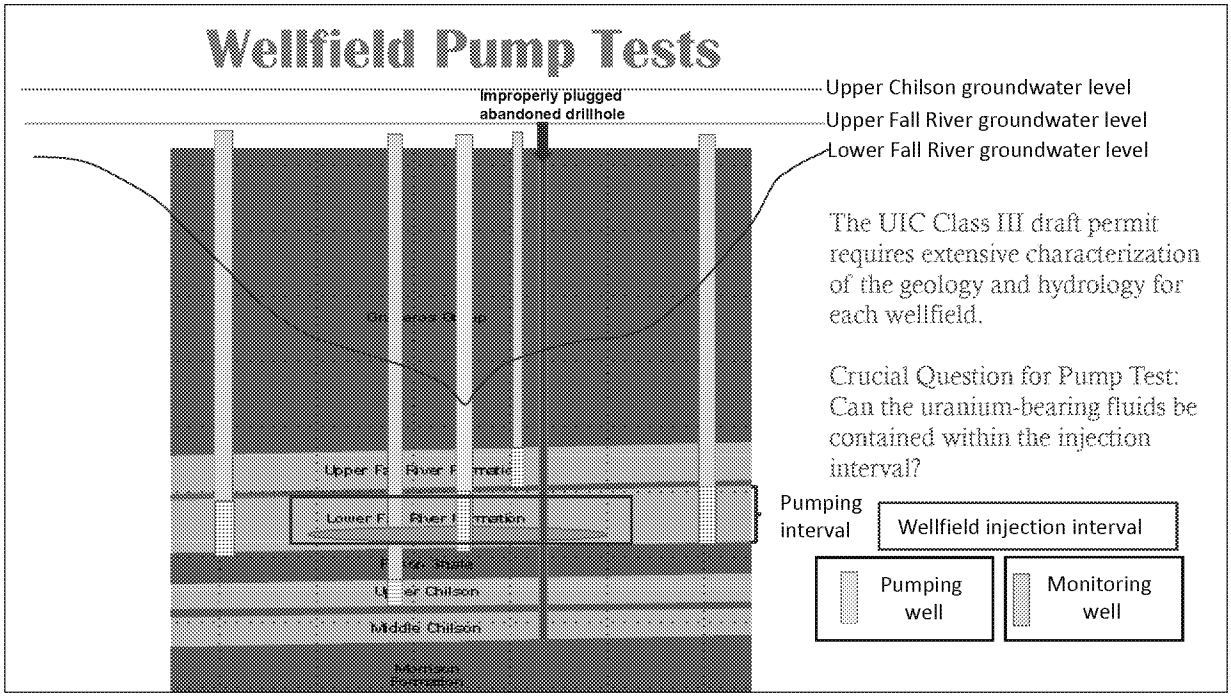
# Vertical Extent of the Aquifer Exemption Boundary



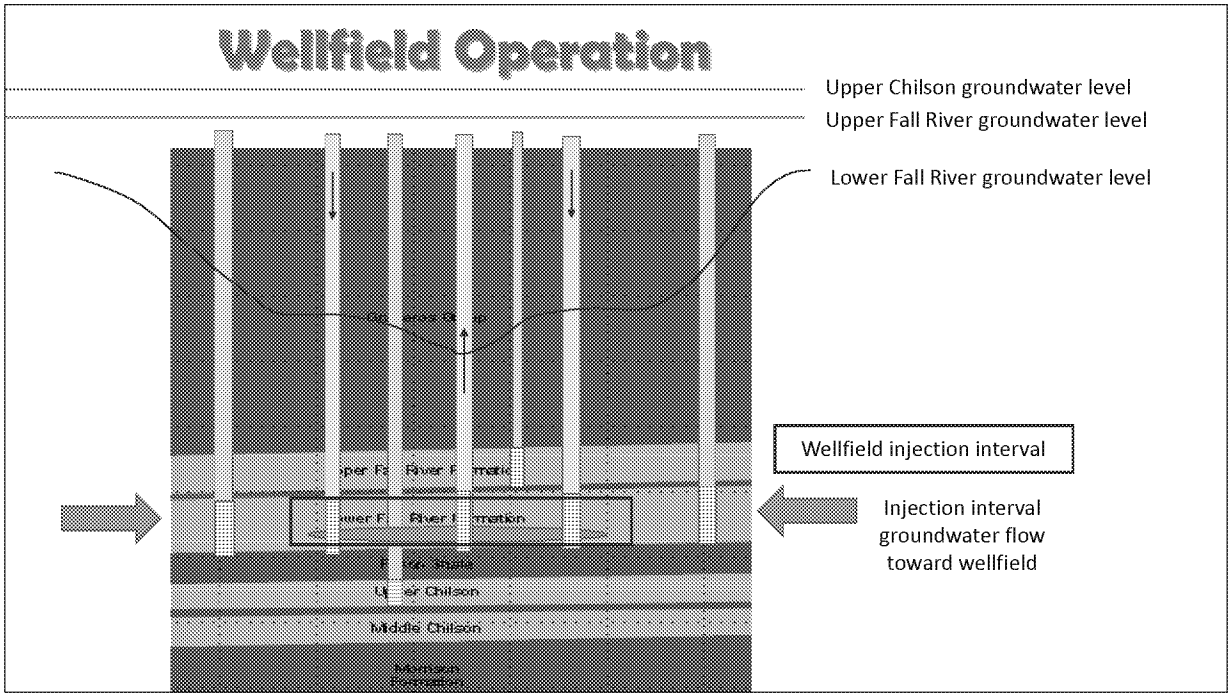

Discuss the vertical extent of the aquifer exemption
Explain the importance of the confining zones above and below the injection zones



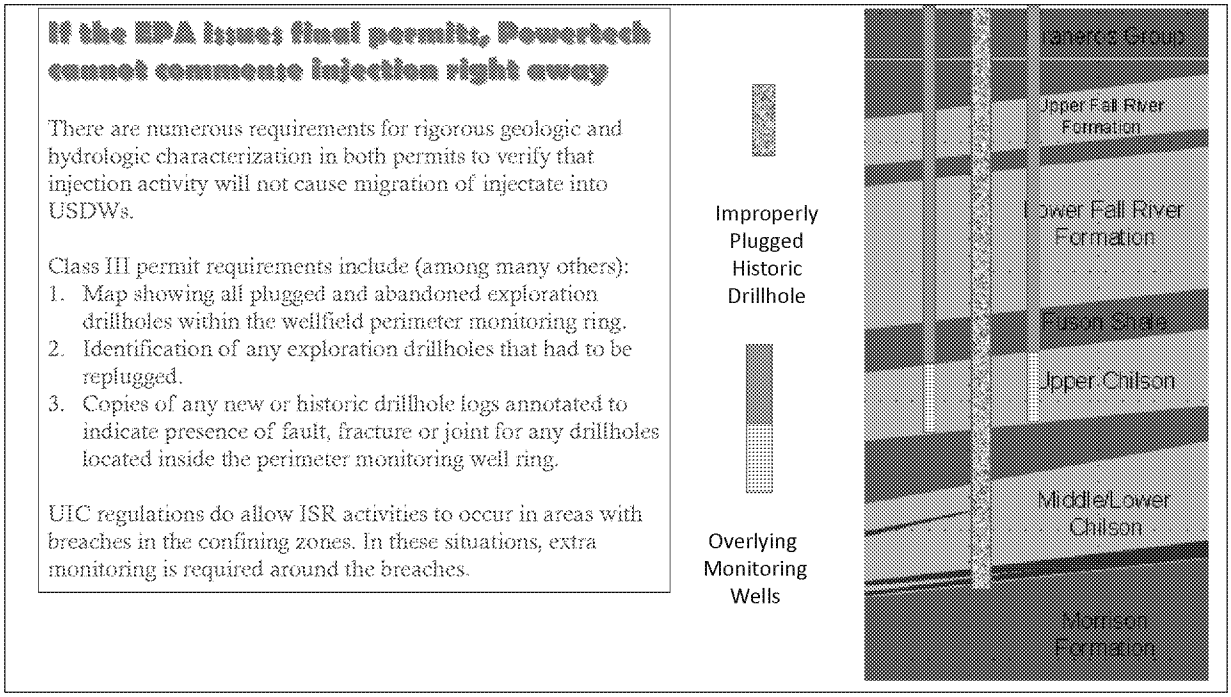

Explanation of ISR process
Point out monitoring wells and explain function




The wellfield pump test data must demonstrate vertical confinement to prevent movement of fluids out of the injection zone so that no USDWs are contaminated.
Wellfield pump tests are the best way to identify breaches in confining zones including fractures and improperly plugged abandoned historic drillholes.
The data must also demonstrate that it is possible to contain injection zone fluids horizontally to prevent contaminant migration into USDWs.
If a wellfield pump test shows a breach in a confining zone that cannot be located, reinjection of groundwater is another test method to help identity breaches in confining zones. The Class III permit contains requirements for both activities.
Emphasize: "Powertech will not be authorized to inject in any wellfield if it cannot demonstrate that USDWs will be protected during ISR operations, restoration, and post-restoration activities."



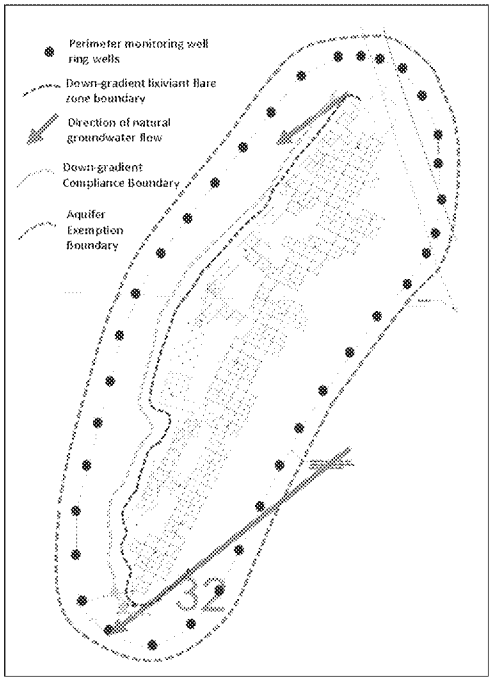

The Class III permit requires inward flow of groundwater toward the wellfield achieved by pumping out more groundwater than is being pumped back into the wellfield.
This requirement remains in effect until the wellfield groundwater has been restored.




Main Point: There is a way to conduct uranium recovery in areas where there are breaches in confining zones that is still protective of USDWs; this is is how it works; and it is addressed in our regulations
Explain how monitoring around breaches in the confining zone works.
"Powertech will not be authorized to inject in any wellfield if it cannot demonstrate that USDWs will be protected during ISR operations, restoration, and post-restoration activities."

# Post-restoration Monitoring

1. Begins after wellfield restoration is complete.
2. The Class III area permit requires a proposed post-restoration monitoring plan before wellfield pump tests begin.
3. Post-restoration monitoring plan includes establishing a down-gradient compliance boundary.
4. Groundwater baseline constituent concentrations are used as the permit limits for determining that no ISR contaminants cross the aquifer exemption boundary.
5. Baseline monitoring begins before wellfield pump tests.
6. Baseline permit limits and strategy for detection of statistically significant increase of an ISR waste constituent above permit limits are based on the RCRA Unified Guidance.

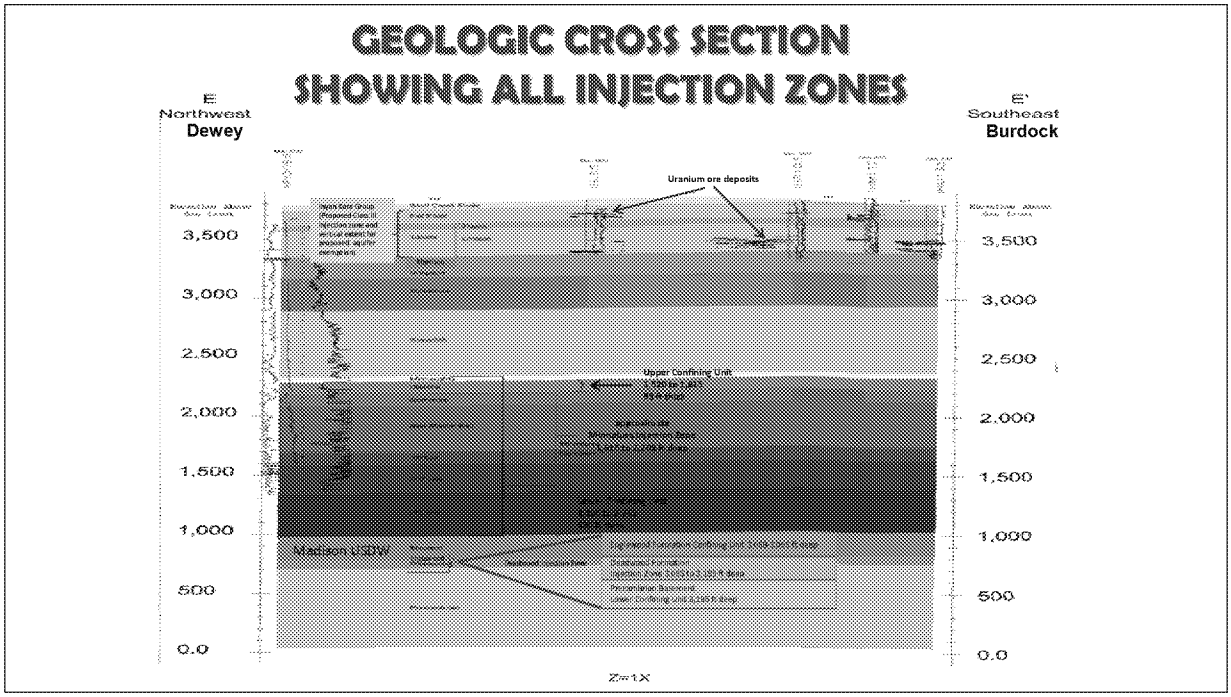



Explain wellfield restoration – NRC regulated. EPA regulates USDWs outside AE boundary
The RCRA unified guidance describes statistical methods for establishing groundwater baseline concentrations and detection of contaminants. These methods have proven to be successful over several years of use under the RCRA program.

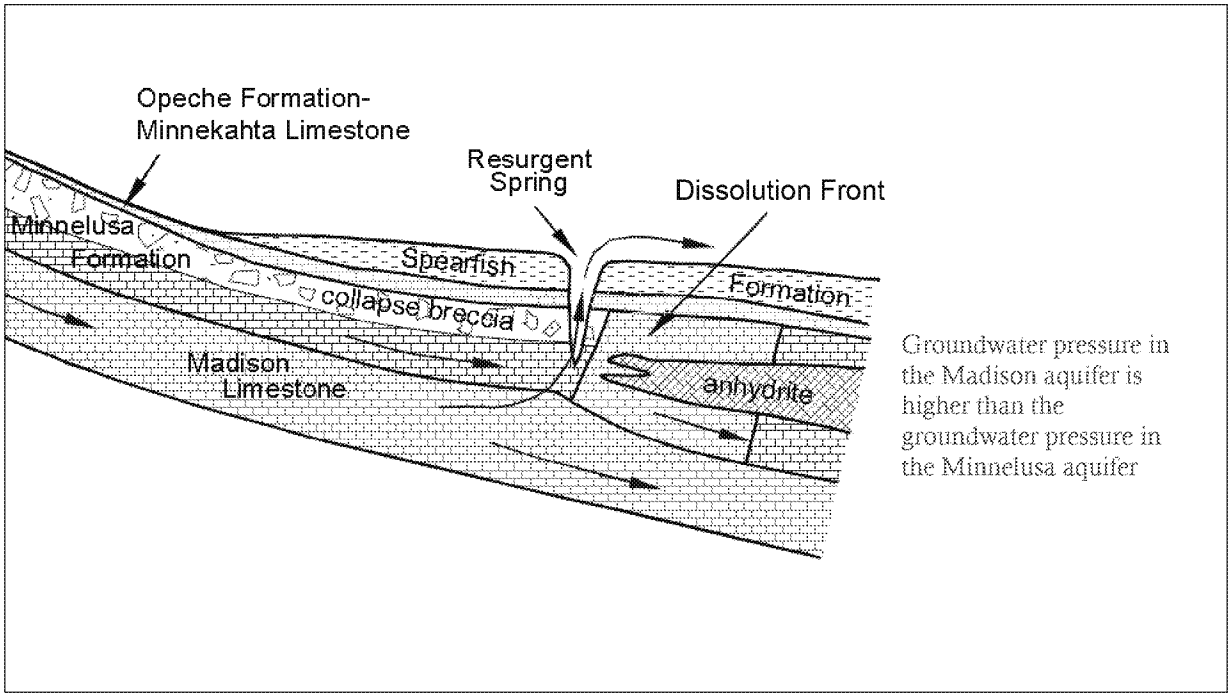
## Class V Deep Injection Wells

- This Class V permit requires the most protective well construction requirements under UIC regulations
- There are numerous requirements for rigorous geologic and hydrologic characterization to verify that injection activity will not cause migration of injectate into USDWs.
- Powertech must demonstrate that the Minnelusa is not an underground source of drinking water (USDW).
- The Class V permit does not allow injection into a USDW.
- The Class V permit requires the injectate to be treated to below radioactive waste and hazardous waste standards.

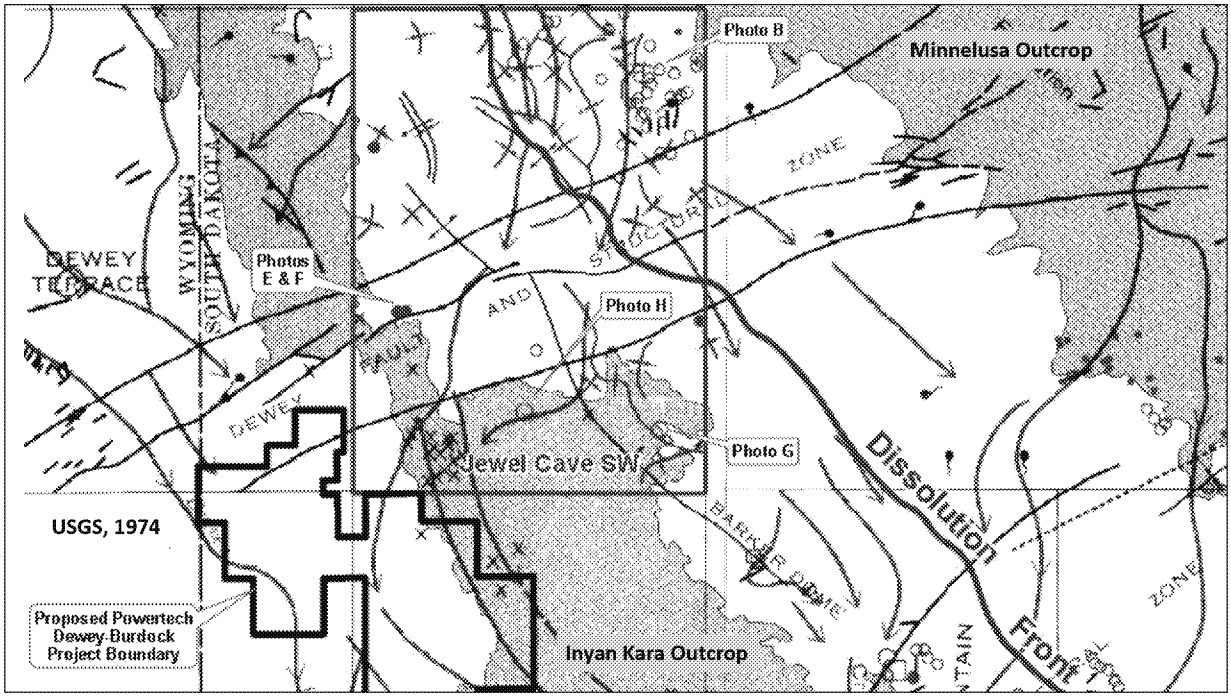
The Sun #1 Lance Nelson is located near the proposed location for DW No. 1. Minnelusa aquifer samples from the Sun #1 Lance Nelson show TDS values ranging from 16,652 to 21,391 mg/L. Based on this information and the fact that the Minnelusa porosity zone contains the soluble mineral anhydrite, the Minnelusa aquifer is not expected to be a USDW.



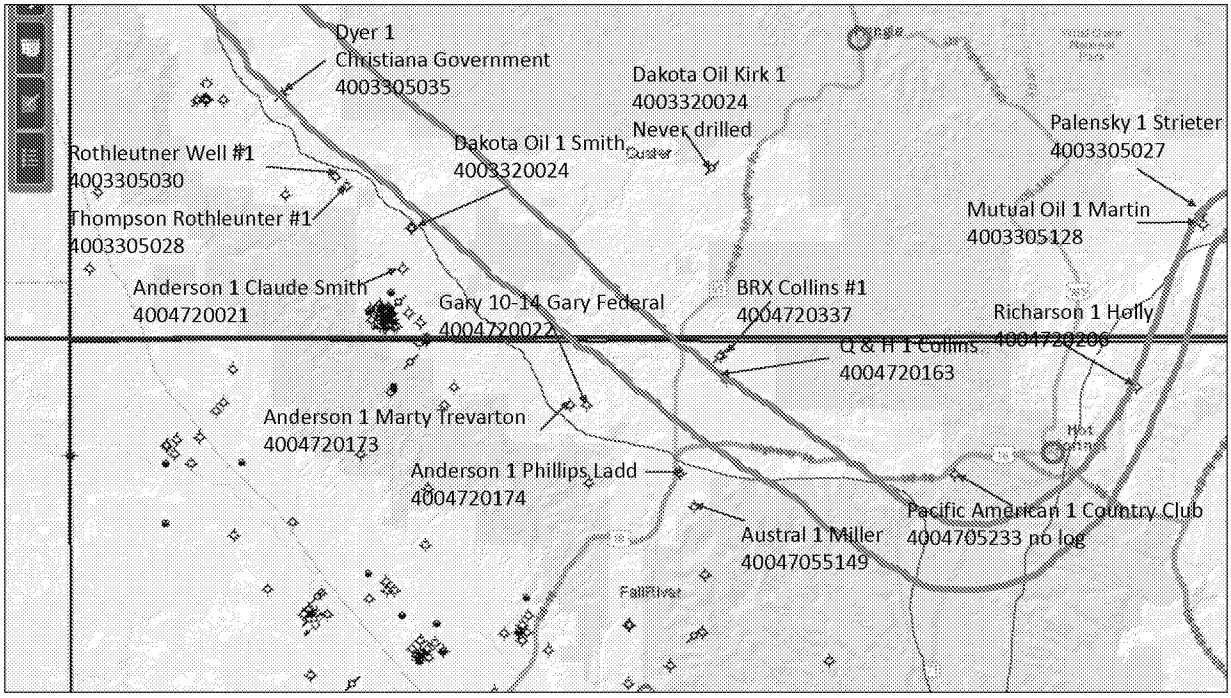

Point out injection zones and confining zones.
Discuss potential for seismicity from injection into the Minnelusa. Point out differences between injection activity in places like OK, AR & CO where injection-induced seismicity occurs and the proposed deep well injection activity at Dewey-Burdock.




Explain process by which breccias are formed, groundwater pressure in Madison is pushing fresh Madison groundwater up into Minnelusa where overburden is thin.
Point out anhydrite which causes Minnelusa water southwest of the injection zone to have high total dissolved solids, high sulfate.
The dissolution front is where the anhydrite is actively being dissolved.
The Minnelusa may be a good source of drinking water in areas near its surface outcrops where the anhydrite has been dissolved away and fresh water is recharging the aquifer.
Mention USGS work that compared water chemistry in Madison and Minnelusa across dissolution front area and change in sulfate concentration in Minnelusa aquifer across the dissolution front area.




Map from 1974 USGS investigation.
This slide shows the location of the dissolution front relative to the Dewey-Burdock project site.
Point out Minnelusa outcrop and dissolution front. Dissolution on the scale of millions of years.

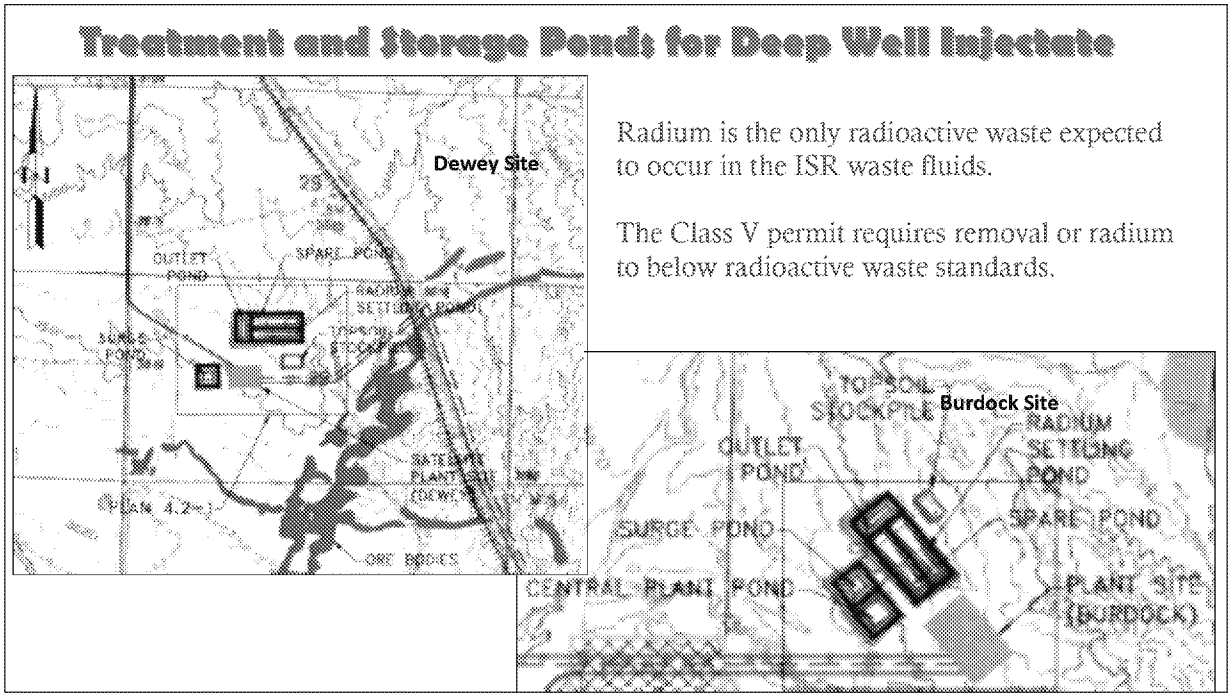



The Minnelusa anhydrite thins at dissolution zone and disappears northeast of the dissolution zone.
EPA has reviewed the well logs of these oil and gas test wells to verify the presence and thickness of the Minnelusa anhydrite and the confining zone overlying the Minnelusa aquifer.

## Class V Permit Requirements to Verify Large Scale Integrity of the Minnelusa Confining Zones:

1. Drill logs from deep Class V wells and plugged oil and gas wells shown in previous slide.
2. Groundwater levels of Minnelusa and Madison aquifers are different when they are not in hydrologic communication.
3. Sulfate concentration.
4. Comparison of Madison and Minnelusa water chemistry.

The Minnelusa confining zones isolate the injectate and prevent it from moving into USDWs.
3 & 4. Mention USGS work that compared water chemistry in Madison and Minnelusa across dissolution front area and change in sulfate concentration in Minnelusa aquifer across the dissolution front area.




Emphasis the ponds are for treatment and storage of Class V injectate. They are NOT infiltration ponds and NOT evaporation ponds.

## Importance of the Public Comment Period & Public Hearings

- The public comment period an important part of the EPA permitting process.
- The reason draft permits are issued is to initiate a public review process to get public input, which may affect the EPA's final decision on these permits.
- EPA regs require a 30 day comment period and a public hearing IF the public requests a hearing.
- This public comment period: March 6 - May 19
- The EPA has schedule five days of public hearings.